

I. The Rejections Under 35 U.S.C. §103

Claims 2, 4, 6-10, and 12-21 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Urano et al in view of Kobayashi et al.

Claims 5 and 11 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Urano et al in view of Kobayashi et al further in view of Tan et al.

Claims 2, 4-10, and 12-21 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Toshiaki et al¹ in view of Kobayashi et al.

Claim 11 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Toshiaki et al in view of Kobayashi et al as applied to claim 21 above, and further in view of Tan et al.

The Examiner's statement of each of the rejections remains substantially the same as previously set forth. In the "Response to Arguments" section, paragraph 7 of the Office Action, the Examiner states that Applicants' arguments have been fully considered but they are not persuasive for the following reasons:

1. The Examiner states that the comparison between Comparative Example 2 and Example 1 does "seem" to show that using p-[1-cyclohexylethoxy)ethoxy]styrene/p-hydroxy-styrene resin gives better pitch dependency and exposure latitude than using p-[1-(ethoxy)]ethoxy]styrene/p-hydroxystyrene. However, the Examiner states to establish unexpected results

¹ The Examiner has provided a full English language translation of JP 11-282163 ("Toshiaki").

over a claimed range, Applicants should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range. The Examiner concludes that there is not enough data to prove that the present resins are better than other resins (including the ones taught in the prior art).

2. The Examiner states that the comparison is not commensurate in scope with the broadest claim "because the organic basic compound is not being claimed in present claim 21," and "the comparison was not made to the closest prior art (Urano et al in view of Kobayashi et al or Toshiaki in view of Kobayashi et al)."

3. The Examiner states that the comparison between Comparative Example 2 and Example 14 is not persuasive to show the unexpected results of using the present resins because those two examples use different photoacid generators and different surfactants. The Examiner notes that not only the resins are different, but also other variables of the comparison are different, thus making the comparison between those two resins difficult.

4. As to Applicants argument that Comparative Example 3 represents Urano et al and that the comparison between the Comparative Example 3 and Examples 1 and 2 of the invention shows that the addition of the photoacid generator (b-2) produces unexpected superior results with respect to pitch dependency and exposure latitude, the Examiner states that "although Examples 1 and 2 do show better pitch dependency compared to that of Comparative Example 3, it is the Examiner's position that the result is not unexpected because Kobayashi et

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al already teaches that using both of those acid generating compounds together improves resolution".

Applicants respectfully submit that the present invention is not anticipated by or obvious over the disclosures of Urano et al in view of Kobayashi et al, alone, or in view Tan et al, or Toshiaki et al in view of Kobayashi et al, alone or in view of Tan et al, and request that the Examiner reconsider and withdraw these rejections in view of the following remarks.

Applicants respectfully submit that the Examiner has not established a prima facie case of obviousness for the reasons previously set forth. However, to advance the prosecution of the case, Applicants have provided additional declaration evidence showing the improved properties of the presently claimed radiation sensitive compositions over the materials of the references of the rejection. See the Executed Declaration Under 37 C.F.R. §1.132 of Mr. Shinichi Kanna, one of the inventors of the present application, attached herewith.

As discussed in further detail in the §132 Declaration, the §132 Declaration is intended to alleviate the Examiner's criticisms with the data of record. The additional inventive examples B1 to B5 and the additional comparative examples B1 to B6 are all free of the amine compound and the inventive samples are formulated to be the closest, direct comparisons with the comparative examples.

Additional inventive Examples B1 to B5 are based on systems containing a resin within the claim of the present invention and two photo-acid generators (b-1) and (b-2), within the claim of the present invention. The additional inventive examples show an unexpected result for each example in terms of pitch dependency and exposure latitude. On the other hand, the additional comparative Examples B1 and B2 use a resin set forth in Urano, which is outside the claims of the present invention. A comparison of the additional inventive examples B1 to B5 with the additional comparative Examples B1 and B2 shows that the unexpected results are not seen with the comparative resins.

Further, additional comparative Examples B3 and B4 each use resin c5 or c11, which are set forth in Toshiaki. Said examples do not contain the photo-acid generator (b-2) of the present invention. A comparison of additional comparative Examples B4 and B5 with additional comparative Examples B3 and B4, respectively, shows that the unexpected results of the present invention are achieved by the use of both of the claimed photo-acid generators (b-1) and (b-2) together with the claimed resin.

Additional comparative Examples B5 and B6 use a resin P1, which is outside the range of the present invention (additional comparative Example B5 also does not contain the claimed photo-acid generator (b-2)). A comparison of additional comparative Example B6 with additional examples B1 to B5 shows that through the use of the claimed resin, unexpected results are attained. And, in additional comparative Example B5, it is evident that both of pitch dependency and exposure

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latitude are further deteriorated as compared with additional comparative Example B6.

Tables B3 and B4 and the related discussion in the §132 Declaration show that resolution can not always be correlated with pitch dependency.

For the above reasons, it is respectfully submitted that the subject matter of claims 2 and 4-21 is neither taught by nor made obvious from the disclosures of Urano et al in view of Kobayashi et al, alone, or in view Tan et al, or Toshiaki et al in view of Kobayashi et al, alone or in view of Tan et al, and it is requested that the rejections under 35 U.S.C. §103(a) be reconsidered and withdrawn.

II. Conclusion

In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the rejections under 35 U.S.C. §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

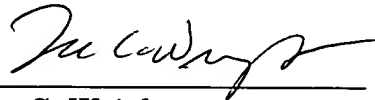
Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case.

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The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Lee C. Wright
Registration No. 41,441

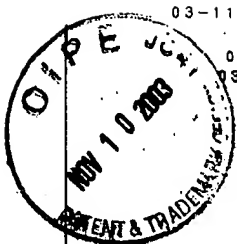
SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373

CUSTOMER NUMBER

Date: November 10, 2003



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Shinichi Kanna, et al.

Group Art Unit: 1752

Appln. No.: 09/748,198

Examiner: LEE, SIN J

Filed: December 27, 2000

For: POSITIVE-WORKING RADIATION-SENSITIVE COMPOSITION

DECLARATION UNDER 37 C.F.R. §1.132Assistant Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

I, Shinichi Kanna, do declare and state as follows:

I am a citizen of Japan.

I graduated from The University of Tokyo, and received a Master's Degree in the course of Chemistry and Biotechnology in March 1998.

Since April 1998 I have been employed by Fuji Photo Film Co., Ltd. and have been engaged in research and development of photoresist photosensitive materials for semiconductors at the Yoshida-Minami Factory Research Division of the company.

I am a co-Inventor of the invention described and claimed in the above-named application, and I am familiar with the subject matter disclosed by the application as well as the Office Action dated July 8, 2003 concerning the application.

In order to demonstrate the unexpected superiority of the present invention, the following experimentation was conducted by me or under my supervision.

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EXPERIMENTATION

Additional Examples B1 to B5 and Additional Comparative Examples B1 to B6

Resist films of Additional Examples B1 to B5 and Additional Comparative Examples B1 to B6 using the compounds shown in Table B1 were prepared, exposed and developed to form a resist pattern in the same manner as in Example 1 of the present specification. Each resist performance (Pitch dependency and exposure latitude) was evaluated in the same manner as in Example 1 of the present specification. The result is shown in Table B1 below.

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Table B1

	Resin (g)	Photo Acid Generator (b-1) (g)	Photo Acid Generator (b-2) (g)	Organic Basic Compound (g)	Surfactant (ppm)
Additional Example B1	P3 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Example B2	P5 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Example B3	P6 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Example B4	Polymer (c5) described in [0044] of Toshiba (JP-A-11-282163)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Example B5	Polymer (c11) described in [0048] of Toshiba (JP-A-11-282163)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Comparative Example B1	Polymer of Synthesis Example (7) described in Urano (US 2,670,288)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Comparative Example B2	Polymer of Synthesis Example (3) described in Urano (US 2,670,288)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Comparative Example B3	Polymer (c5) described in [0044] of Toshiba (JP-A-11-282163)	PAG-A1 (0.08)	-	-	R08 (100)
Additional Comparative Example B4	Polymer (c11) described in [0048] of Toshiba (JP-A-11-282163)	PAG-A1 (0.08)	-	-	R08 (100)
Additional Comparative Example B5	P1 (0.16)	PAG-A1 (0.08)	-	-	R08 (100)
Additional Comparative Example B6	P1 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)

In Table B1, the compounds other than Polymers (c5), (c11), Polymer of Synthesis Example (7) and Polymer of Synthesis Example (3) are those in the present specification.

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Table B2

	Iso/Dense difference ΔCD	Exposure Latitude Δexp
Additional Example B1	15.1 nm	13.1%
Additional Example B2	14.8 nm	13.3%
Additional Example B3	15.0 nm	12.8%
Additional Example B4	19.2 nm	13.5%
Additional Example B5	19.0 nm	13.0%
Additional Comparative Example B1	25.0 nm	8.6%
Additional Comparative Example B2	25.3 nm	8.9%
Additional Comparative Example B3	51.0 nm	3.6%
Additional Comparative Example B4	49.0 nm	4.8%
Additional Comparative Example B5	48.1 nm	5.4%
Additional Comparative Example B6	25.1 nm	8.6%

By taking into consideration the aspect pointed out by the Examiner, the additional examples B1 to B5 and additional comparative examples B1 to B6, all of which were a system free of amine, and formulated each ingredient to be common so that the direct comparison of the examples with the comparative examples is possible.

Additional examples B1 to B5 are based on systems containing a resin within the claim of the present invention, and two photo-acid generators (b-1) and (b-2) of the present invention. And an excellent result is obtained for each example as regards pitch dependency and exposure latitude.

On the other hand, additional comparative examples B1 and B2 use a resin set forth in Urano and outside the claim of the present invention (Note that this resin has a structure similar to that of the resin of the present invention). Comparison of additional examples B1 to B5 with additional comparative examples B1 and B2 reveals that in additional comparative examples B1 and B2, sufficient effects are

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not attained in both of pitch dependency and exposure latitude, and thus shows the feature of the present invention that, by choosing a resin having a specific structure, a specific effect can be achieved.

Further, additional comparative examples B3 and B4 each use resin c5 or c11, which is set forth in the referred Toshiaki and in the range of the present invention, and does not contain photo-acid generator (b-2) of the present invention. Comparison of additional examples B4 and B5 with additional comparative examples B3 and B4, respectively, shows the specific feature of the present invention that, through the combined use of photo-acid generators (b-1) and (b-2) both being in the range of the present invention together with the specific resin, excellent effects are attained in both of pitch dependency and exposure latitude.

Still further, additional comparative examples B5 and B6 use a resin P1, which is outside the range of the present invention. By way of precaution, additional comparative example B5 does not contain photo-acid generator (b-2), either. Comparison of additional comparative example B6 with additional examples B1 to B5 shows the feature of the present invention that, through the use of the specified resin, specific effects are attained. And, in additional comparative example B5, it is evident that both of pitch dependency and exposure latitude are further deteriorated compared with additional comparative example B6.

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Additional Examples B6 to B7 and Additional Comparative Examples B7 to B8

Moreover, in order to show that Resolution does not always correlated well with pitch dependency, the following additional examples B6 and B7 as well as additional comparative example B7 and B8 using the compounds shown in Table B3 were carried out in the same manner as in Additional Example B1 above.

Table B3

	Resin (g)	Photo Acid Generator (b-1) (g)	Photo Acid Generator (b-2) (g)	Organic Basic Compound (g)	Surfactant (ppm)
Additional Example B6	P2 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	-	R08 (100)
Additional Example B7	P2 (0.16)	PAG-A1 (0.04)	I-1 (0.04)	E-1 (0.0015)	R08 (100)
Additional Comparative Example B7	P2 (0.16)	PAG-A1 (0.08)	-	-	R08 (100)
Additional Comparative Example B8	P2 (0.16)	PAG-A1 (0.08)	-	E-1 (0.0015)	R08 (100)

• Evaluation of Resolution

Critical resolution was defined as follows. At first, the exposure amount was determined to obtain a 0.16 μm pattern size for the exposure through a mask having a line-and-space pattern that corresponds to the dimension of 0.16 μm . When finer patterns were used for exposure with the exposure amount thus determined, the minimum line width at which the exposed patterns are isolated and resolved, was defined as the critical resolution.

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Table 4B

	Resolution	Pitch dependency	Exposure Latitude
Additional Example B6	0.14 μ m	15.1 nm	13.8%
Additional Example B7	0.14 μ m	15.1 nm	13.5%
Additional Comparative Example B7	0.14 μ m	30.1 nm	9.0%
Additional Comparative Example B8	0.14 μ m	30.0 nm	9.0%

Comparison of additional example B6 with additional comparative example B7 along with comparison of additional example B7 with additional comparative example B8 shows that no difference is recognized as for resolution, but that additional examples 6 and 7 exhibit advantageous effects in pitch dependency and exposure latitude.

Namely, the cited reference (US 6136500: Kobayashi) states that the "resolution" is enhanced by the use of two kinds of photo-acid generators. However, as is evident from the results shown above, the present applicant takes a position that "resolution" does not correlate with the "pitch dependency" that is related to the advantage of the present application.

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As the factors determining the contrast between the unexposed and exposed portions, (i) the contrast in the dissolving speed of the resin into an alkali depending on the change in exposure amount, and (ii) the spatial dissolution contrast of the image changed by the diffusion of acid can be mentioned for example. As for resolution, higher contrasts in (i) and (ii) are preferred, but regarding pitch dependency, (i) must be small and (ii) must be high.

Accordingly, resolution and pitch dependency are not always in correlation with each other.

The present applicant speculates that, when two types of photo-acid generators are used together with a resin falling in the range of the present application, the dissolution contrast in (ii) is enhanced to improve pitch dependency.

As has been explained in detail, the present invention achieves unexpected, excellent effects by using a specific resin and two types of photo-acid generators. Hence, the present invention is not obvious from the descriptions set forth by the cited references.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectively submitted,

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Date: 2003 11/17

Shinichi Kanna

Shinichi Kanna